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EDITORIAL NOTES

B.C.G.A. ACTIVITIES

UNDER the heading "Out of the Limelight" in these columns last week we commented on the wartime activities of the British Commercial Gas Association, and discussed the question of national advertising in the Press. It is some time ago now that the decision was reached by the Gas Industry, in concert with the electricity industry, that the taking of space by either industry, for the purpose of selling or of prestige advertising, should be suspended until further notice. This decision is thoroughly understandable under the conditions with which we are faced, and we never had any quarrel with it; but we did suggest last week that it might prove helpful if from time to time something was done by the Gas Industry, working through the B.C.G.A., to inform the public of steps of importance the Industry might take in the interests of consumers—the giving of information, and not advertising in the sense of selling or of endeavour to enhance prestige. We said that Mrs. R. or Mr. S. would not grudge a small expenditure, even by a public utility undertaking, in the extraordinary conditions of to-day on what might and probably would prove a lively benefit. We are glad to be assured that sight is not being lost by the Executive Committee of the worth of this notion, and that the Association is prepared to make announcements such as the type we have in mind when the occasion appears to justify the step.

We also referred last week—as, indeed, we have made reference previously in the "JOURNAL"—to the extremely good work the Association continues to carry out in unobtrusive fashion but with telling effect for the Gas Industry. We mentioned the reduction in staff—inevitable, of course—from 73 in peacetime to 27 at the present time. Every one, we remarked, of the staff officers and staff is working to capacity. Government departments are looking to national organizations for advice and assistance, and it is no secret that they have found, and are finding in increasing measure, the B.C.G.A. a very active and a very helpful body. As a result of the Association's efforts close collaboration of a most valuable character—we are thinking again in terms of public interest in its broadest sense—has been established with the Ministry of Food, the Ministry of Information, and the Ministry of Education. The Association is constantly being consulted by these Ministries concerning such matters as food, educative films, display, literature, and general Gas Industry policy.

The Home Service Department is doing admirable work in collaboration with the Ministry of Food; publicity material, prepared in connexion with the National Food Campaign, has been taken in unprecedented quantities by gas undertakings throughout the country, and a large number of articles has appeared in the national and also the local Press indicating the economy effected by the use of gas in the right manner for all sorts of dishes. Through the Association demonstrators are kept *au fait* with the food position from week to week. The Studio is very busy indeed, in touch with the Ministry of Information, in producing display material. Then there is a great and growing demand for films. Among the new films issued are "Green Food for Health," "Casserole Cookery," and "Choose Cheese." None of these films can be regarded as direct gas propaganda, but they do bear the title: "The Gas Industry presents to the Ministry of Food for the National Food Campaign the following Film." The Industry, it should be mentioned, has access to the film libraries of both the Ministry of Food and the Ministry of Information, and a film dealing with the by-products of gas is being adopted by the British Council for display overseas. Distribution of goodwill publicity material taking many forms goes ahead. As examples may be mentioned the circulation of a half a million copies of Sir John Orr's broadcast, and nearly a quarter of a million copies of "Meals with a Difference"—and it may be mentioned, too, that as a result of the sale of over 50,000 copies of "A Kitchen Goes to War," the sum of £100 has been contributed to the Red Cross Fund. There is no doubt at all that in these and many other activities the British Commercial Gas Association is carrying out sterling work under conditions the reverse of easy.

THE NEED FOR STANDARDIZATION

DURING the year or so preceding the outbreak of war considerable discussion centred on the terms on which various gas undertakings offered appliances to their consumers. The question, as we have often emphasized, is one of importance, and views have been ventilated freely on it in the "JOURNAL." We found it very difficult to understand the extraordinary divergence of policy on what appeared to us a matter bristling with no special difficulties. Arguments have been advanced based on local conditions, maintenance costs, and—in those peaceful days—competition. None convinced us, however, that more uniform pricing was impossible or even difficult of attainment. What was needed, we suggested, was less whim and more co-operation. Then, of course, to make the situation more complicated, we had individual undertakings insisting on minor modifications of appliances to meet "local conditions" while at the same time demanding cheaper appliances. The extent of this price disparity was truly bewildering. For a certain widely known make of cooker, for example, the con-

QUARTERLY INDEX

We propose to issue the July—September Index only to those who require it but not to incorporate a copy in every "JOURNAL" as is done in more normal times. Obviously any of these which might be superfluous would entail unjustifiable paper consumption. We should be glad if those subscribers who wish to receive a copy would please notify us not later than Sept. 30. We shall keep a record of those who apply so that there will be no need for them to make application for subsequent quarters. We feel sure that we shall receive willing co-operation from our readers in this important matter of paper conservation.

sumer in one town had to pay nearly £5 more than in another town. The discrepancy in the terms offered for a certain multi-point water heater—again of well-known make—was even more astonishing. We recall a Paper given last year in which the Author set out the charges made for this particular appliance by 22 gas undertakings. The difference between the maximum fixed price and the minimum fixed price was £12 10s. This could not be explained away by the incidence of "local conditions." We did not suggest that appliances should be put out at a loss; on the other hand we could find no merit in the policy adopted by some undertakings of overloading the cost prices of appliances with charges for fixing, maintenance, and interest, and in addition an amount representing a handsome profit. It is to be admitted that some progress was being made towards greater uniformity in the matter. As example, all undertakings in the western group adjoining the Gas Light and Coke Company came to an arrangement whereby they sold appliances at the same prices as that Company. The movement was not, however, general.

Our views on the question are shared by Mr. A. B. Munro, of Edinburgh, who prepared a Paper for a meeting of the North British Association of Gas Managers. In Scotland, he stated, each undertaking has its own method of arriving at selling, hire purchase, and simple hire rates, with the result that one finds that the public are suspicious at having to pay more in some areas than in others for the same goods. He urged the establishment of a regional committee to investigate the subject of standard prices, suggesting that if the large buyer is able to get more advantageous rates from his suppliers he no doubt spends more in normal times in marketing than does the smaller undertaking which has to be content with the minimum discount on his purchases. He argued, too, and we think rightly, that such a scheme would help to make the hire purchase transfer scheme more general.

Mr. Munro's Paper, which includes an explanation of the Edinburgh Gas Department's wartime selling policy in regard to appliances, will be found on later pages of the "JOURNAL" to-day. Also published in this issue is the Paper by Mr. J. M. Dow, on oxide purification, also prepared for the North British Meeting.

Personal

Councillor JOSEPH S. HARGREAVES is the next Mayor of Accrington. For very many years Mr. Hargreaves has been an active member of Accrington District Gas Board.

Obituary

Following a serious operation, Mr. SAMUEL BICKLEY passed away on Sept. 3 at the age of 72. For 36 years Mr. Bickley represented the Manchester Paint & Varnish Co., Ltd., and his cheery manner and personality won him many friends throughout the Gas Industry.

Forthcoming Engagements

Sept.

16.—I.C.C.A.—Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 2.30 p.m.

17.—I.G.E.—Gas Education Executive Committee, 11 a.m.; Gas Education Committee, 2 p.m.

19.—Gas Research Board.—Refractory Materials Joint Committee, 2.30 p.m.

26.—Gas Research Board.—Joint Committee on Complete Gasification under Pressure, 2.30 p.m.

26.—Wales and Mon. Association.—General Meeting at Cardiff, 11 a.m.

27.—Gas Research Board.—Joint Research Committee, 2 p.m.

27.—I.G.E.—Liquor Effluents and Ammonia Committee, 12.15 p.m.

Oct.

1.—Gas Research Board.—Finance Committee, 12 noon; Council, 2.30 p.m.

7.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; General Purposes Committee, 3 p.m.; Benevolent Fund Committee of Management, 4.30 p.m.

8.—I.G.E.—Council, 10 a.m.

9.—I.G.E.—Board of Examiners, 2 p.m.

15.—I.G.E.—Gas Education Executive Committee, 2 p.m.

Letter to the Editor

Pitch Briquettes

SIR,—In your issue of Aug. 28, on p. 361, you published an article under the heading of "Crude Tar Prices," in which there was a suggestion for the advantageous use of coal tar pitch, which at the present time is tending to become a decided drug in the market, and also of gas coke breeze.

The article pointed out that by utilizing these two materials and making them into ovoid briquettes a very satisfactory fuel could be produced, not only for industrial purposes, but also for the special purpose of creating to a certain extent a smoke screen on the lines recommended by the Ministry of Home Security (Smoke Production Division). The manufacture of briquette machinery has been our chief speciality now for many years, and we have supplied our briquette plants during that period to many firms in all parts of the world for briquetting all classes of materials for heating and smelting purposes. Actually at the present time the manufacture of coke breeze briquettes on the lines suggested by the writer of the article in your issue would, in our opinion, be definitely of national importance, for it would not only enable the two materials to be used more advantageously. By the addition of an excess quantity of pitch the fuel could be made to be definitely of a very smoky character.

With regard to the figures given for the estimated cost, while we are generally in agreement with these, from our experience in the manufacture of this type of briquette we consider that these figures should be modified. As a general rule, for most qualities of coke breeze, 9% of pitch is quite sufficient to produce a very satisfactory and hard briquette. If this percentage of pitch were increased to, say, 12%, the fuel would be of a definitely high smoke producing quality, but if this percentage were to be still further increased to the figure mentioned in the article—*i.e.*, 20%—the resultant mixture of 80% breeze and 20% pitch would be too "rich" and sticky to compress satisfactorily into briquettes, and moreover, the briquettes when charged on to the boiler or other industrial fires would tend to soften and run in the fire. We should recommend that the percentage of pitch should not be higher than, say, 12% at most. Moreover, we notice that the writer of the article suggested coke breeze from, say, ¾ in. to dust. We should recommend preferably that the breeze should be screened, and all pieces above ⅛ in. taken out before the screened breeze is delivered to the briquette plant. The screened coke breeze would readily find a market either for closed domestic stoves or for several industrial purposes.

We think that the figures of the estimated cost as given in the article should be modified on something like the following lines:

Estimated Cost

Materials:			
Pitch 12% at present-day average price of 40s. ...	£2	10	0
Coke breeze, say, under ⅛ in. to dust, at 7s. 6d. ...	3	5	6
Steam for use in vertical heater, and power for driving plant		5	0
Labour:			
Two labourers at 1s. 3d. per hour	1	0	0
Standing Charges:			
10-tons at 6d. per ton		5	0
Depreciation and Repairs:			
10-tons at 1s. 6d. per ton		15	0
Total cost for 10-tons	£8	0	6

We agree that these ovoid briquettes could be sold very readily at a price of from £1 10s. to £2 per ton, thus leaving a very satisfactory margin of profit in the manufacture of this fuel.

Owing to the abrasive nature of coke breeze as compared with coal, the cost of repairs and renewals on briquetting plant is higher than that of briquette plant dealing with coal only, and we have increased this cost considerably over the original estimate.

Yours, &c.,

A. E. N. YEADON.

Yeadon, Son & Co.,
4, Albion Place,
Leeds, 1.
Sept. 2, 1940.

Reduction in the Calorific Value of the gas sold in the Corporation area of supply from 475 B.Th.U. per cu.ft. to 460 B.Th.U., has been approved by the Rochdale Town Council. Alderman Ashworth told the last meeting of the Council that some months ago the Corporation installed a benzole plant, and had been urged by the Mines Department to produce the maximum quantity. The effect of the change would be to reduce the price of gas by approximately 2d. per 1,000 cu.ft. in the case of the average domestic consumer.

New Gasholder Inaugurated

An important event took place recently at a Gas-Works in the North when the Mayor of the town performed the ceremony of

A view of the new 3-million cu. ft. holder. The diameter of the tank is 176 ft., and the total height from ground level to the top of the crown 177 ft. 6 in.

opening the outlet valve of a new 3,000,000 cu.ft. spiral gasholder.

The Gas Engineer and Manager, in an interesting speech, remarked that the completion of the holder during the war period had caused no trouble, thanks to the cordial relations and goodwill which existed between the Undertaking and the Contractors, Messrs. Ashmore, Benson, Pease & Co., Ltd. He complimented the Contractors upon the workmanship and finish of the holder, adding that in the whole of his experience in the Gas Industry he had known no other contract of this magnitude to be carried out so smoothly and efficiently. He also mentioned that the holder which was now being put out of commission was erected by the same firm over 60 years ago.

Mr. N. E. Rambush, the Managing Director of the Contractors, replying on behalf of his Company, also referred to the happy relations which had existed among all concerned with the work. The occasion was taken by him to present souvenirs in commemoration of the inauguration.

Benzole Plant is to be installed at North Berwick Gas-works. The contract has been placed with Messrs. Henry Balfour & Co., Ltd., of Leven.

Over Gas Showrooms, which were slightly damaged during an air raid in a north-west town last week, large Union Jacks flew the following day.

A Reduction in the Price of Gas of 3d. per 1,000 cu.ft. has been decided upon by the Burntisland Town Council. The price is now to be fixed at 3s. 11d. per 1,000 cu.ft. to ordinary meter consumers and 4s. 4d. to pre-payment meter consumers.

Making the Most of Your Rationed Meat was the topical subject of a recent session of gas cookery demonstrations arranged by the Leamington Priors Gas Company at their Regent Street Showrooms. The demonstrations are being held each Wednesday afternoon at 3 p.m.

Staffs Working in Relays is the latest war innovation in Lancashire gas showrooms. Rotas for duty have been drawn up, and when air raids occur during the night the scheme automatically comes into operation. In this way on the day following an air raid the staff only work half-time.

During an Air Raid on a north-western town during daylight recently, Miss E. Sanderson, of the Radiation Research Kitchen, who had been giving a series of wartime cookery demonstrations in the district, found herself with an audience of a hundred people—mostly women shoppers—in a large public shelter. She took the opportunity of giving them a few hints on gas cookery.

OXIDE PURIFICATION—
WARTIME PRACTICES AND SUBSTITUTES*

by
JAMES M. DOW,
of Kirkcaldy

The removal of H_2S from the gas stream by means of oxide of iron has been so long universal practice that a Paper on the process at this date can hardly be expected to reveal anything of exceptional value. Nevertheless, the advent of the war has resulted in the cutting off for the time being at any rate of the chief sources of supply of purifying materials, compelling many of us both to revise our pre-war methods and to look around for suitable substitutes.

Purifier Practice

Apart from the routine changing of the rotation of the boxes, I have been struck many a time by the little thought most of us give to improving the efficiency of an established practice. Perhaps it is because we know purification costs cannot be avoided, and that having established a figure in our annual accounts we are anxious not to disturb it. Or is it that most of us have learned to regard oxide purification as a mechanical process dependent almost entirely on the successful manipulation of a complicated system of valves? How many of us have fixed our days and times for changing the rotation of the purifiers, and come summer, come winter, we refuse to be put off our routine. We have no thought for the oxide under the cover, as long as it performs its duty reasonably well without causing the exhauster too much heart-burn. Is it not better practice to change the rotation of the first taker after the latter has dealt with a predetermined fixed volume of gas? By so doing, each box would be receiving the same treatment, and one would be better able to judge the performance of the "Oxide" instead of the "purifiers."

Then again we must now be more considerate of our purifying materials if we are to make existing stocks last for the duration. It is true that the spent Oxide markets prior to the outbreak of the war were hardly worth catering for. Many of us preferred a saving in labour costs to working up an oxide to a saleable sulphur concentration. But the war has changed all this. Materials come before labour these days, and we must employ a little more skill in the handling of our purification problems. How does the following method appeal to you?

Prepare a colour index for your various batches. Each colour will denote the number of times a batch has been in operation—viz,

BLUE	for the 1st Fouling			
GREEN	„	„	2nd	„
YELLOW	„	„	3rd	„
RED	„	„	4th	„ &c.

Fill No. 1 tier with "blue" oxide, No. 2 with "green" oxide, No. 3 with "yellow" oxide, and No. 4 with "red" oxide, and so on. Complete the cycle of foulings giving each oxide similar treatment until you have produced a really saleable spent oxide. I know at least one Works in Scotland where this system has operated quite successfully for many years, but you must not be tempted to add just a touch of fresh oxide to any of the batches when changing a box, otherwise you completely upset the final results, and are invariably left with heavy stocks of partially spent material.

Valuation of an Oxide

An earlier Paper to the Association by Mr. D. V. Reid, of Gourock (September, 1931), laid before you some valuable data relative to the behaviour of oxides under varying conditions of temperature and moisture—two very important points on the valuation of an oxide, but unfortunately the designers of oxide purification plant have done little to accommodate these points.

It is extremely problematical if conditions of humidity and temperature can be obtained in practice to meet the requirements of a particular oxide. One is perforce, therefore, to select or prepare an oxide that will give best results over a

* Paper prepared for the Annual General Meeting of the North British Association of Gas Managers.

wide range of varying conditions. This invariably means blending, and as most of us will be compelled to do this sooner or later in one way or another, I have prepared an illustration of the method employed at Kirkcaldy for determining experimentally the blend best suited for our plant.

The Author exhibited two drawings at the meeting.

The method is simply to determine the activity under varying temperature conditions of the available oxides; then to blend these oxides so as to produce a mixture capable of giving as near as possible the activity desired.

The plotting of the activity curves in the manner shown helps one to compare the varying degrees of activity of the various oxides and blends under similar conditions. The zoning of these curves over different coloured sections marking off definite stages of activity, assists one further in the search for the ideal. On studying the results, first from the "available" oxides, we find

(1) That No. 1 (By-Product) Oxide is two distinct zones of activity above the remaining three.

(2) That No. 2 (Synthetic Oxide), No. 3 (Natural Oxide), and No. 4 (Partially Spent Oxide) are all in the blue zone at low temperatures.

The conclusions from these results are: No. 1 will undoubtedly be fiery and may prove difficult to handle under high sulphur concentrations, and Nos. 2, 3, and 4 will all be definitely sluggish at low temperatures: No. 2 especially will require careful watching. The obvious solution is to blend the oxides. The excessive activity of No. 1 would enliven the activity of the three other oxides, especially at low temperatures. It was considered that if a blend could be produced that would produce an activity curve extending throughout the "red" zone, this would best suit our purpose. It will be noted that this was more or less obtained by the following mixture:

75 per cent. of No. 3 Oxide
10 per cent. „ No. 4 „
10 per cent. „ No. 2 „
5 per cent. „ No. 1 „

There is no doubt, however, that further tests might have produced a simpler formula. This formula is, however, best suited our purpose, and the practical results obtained have since proved its merit. Perhaps the point of most interest was the very small percentage of No. 1 oxide required to produce the desired result.

Capacity of an Oxide

It has long been realized that although an oxide might prove itself to be impressively active, its capacity for H_2S may be so limited as to make it more or less useless for practical purposes. It is generally recognised that capacity is largely dependent on the active iron content. The active iron content is determined by ascertaining the percentage free sulphur thrown down over a series of fouling and revivifying cycles—viz:

$$2Fe_2O_3 + 6H_2S = 2Fe_2S_3 + 6H_2O \quad \ldots\ldots\ldots(1)$$
$$2Fe_2S_3 + 3O_2 = 2Fe_2O_3 + 6S \quad \ldots\ldots\ldots(2)$$

1.66 per cent. $Fe_2O_3 \rightleftarrows$ 1 per cent. S.

Where skilled laboratory assistance is available, the test described by Weyman (Journal Chem. Ind., p. 333, 1918) is recommended; the capacity being expressed as follows:

$$\frac{\text{Increase in Weight}}{\text{Weight of } Fe_2O_3 \text{ in sample}} \times 100$$

It may be of interest to study the results of this test on the oxides already under review:

Sample.		% Free	% Dry Basis.				* Capacity for absorbing moist H_2S gas based on 4-hour cycles.		
No.	Source.	H_2O	SiO_2	Al_2O_3	Fe_2O_3	Na_2O	1st cycle.	2nd cycle.	3rd cycle.
1	By-Product (Foreign)	49.55	2.55	10.09	55.60	4.16	56.9	55.9	51.4
2	Synthetic (British)	27.92	13.36	8.58	47.31	0.67	48.2	53.8	48.8
3	Natural (Foreign)	30.25	6.35	6.55	62.70	—	47.4	55.3	50.1
4	Partially Spent	18.71	13.41	5.60	34.70	—	25.1	22.4	26.1
†5	By-Product (British)	23.35	8.41	15.26	56.14	6.44	1.8	2.92	3.37

* Max. theoretical capacity equal to 63.75.
† By-product mud from British aluminium industry.

Substitutes

Is there any other method of H_2S removal more economical than oxide of iron? We have read much recently of various methods of wet purification, capable of arresting all, or nearly all, of the sulphur compounds. It would appear that none of them is sufficiently convincing either economically or otherwise to make one depart entirely from oxide of iron. But what is to be the position when the existing stocks of imported oxides diminish? True we must look around for suitable substitutes, but these substitutes must have similar characteristics to the existing materials, if our existing plant is to be used.

There is an important heavy industry in this country that produces annually as by-product waste thousands of tons of red mud, rich in iron oxide. For years covetous eyes have been cast on this material. Efforts have been made to use it for various processes, but still its stock continues to grow, and is becoming more and more a landmark in the district. Early attempts have been made to harness it for oxide purification purposes, but in spite of its relative chemical similarity to other established oxides (see oxide No. 5 in aforementioned table) it remained relatively "dead" to H_2S. Investigation of the cause of this inactivity has proved that this is due to the presence of sodium aluminium silicate. This appears to protect the oxide from H_2S penetration, by enshrouding the particles in a wall of "water glass," hence interfering with its state of hydration. Early attempts to liberate the oxide were only partially successful. The "mud" was calcined in a reducing atmosphere produced by mixing it with coal dust or by producer gas. The "treated" oxide had, however, purely a catalytic effect on the breaking up of H_2S—*i.e.*,

$$Fe_2O_3 + H_2S + O = Fe_2O_3 + S + H_2O.$$

As a commercial reagent it could not compete with the "active" oxides then available, and apart from a few Undertakings who were prepared to experiment, little was heard of it. Investigation, however, did not stop there. It was felt that if this protective layer could be destroyed, the liberated oxide should sulphide. Acid washing was resorted to, and this has met with a considerable measure of success. Naturally, the cost of this process adds to the production costs of the oxide, and greatly depends on the price of the acid used. For this reason sulphurous acid has been employed, and the following results show the effect of the washing on the activity of the residue:

Grms. SO_2 per 100 grms. of Mud.	1st Fouling.		2nd Fouling.	3rd Fouling.
	4 hrs.	22 hrs.	4 hours.	4 hours.
16.0	3.70	23.24	33.41	38.97
21.4	4.31	29.64	46.52	44.34
32.0	4.99	39.31	43.77	41.20

On a basis of 20 grammes of SO_2 per 100 grammes of dry mud, using spent oxide containing 50 per cent. free sulphur, 95 per cent. of which it should be capable of converting into SO_2 solution, the cost should not prove excessive. It must be noted, of course, that further investigation is still necessary to improve the activity of the treated mud during the first fouling. It would appear that the penetrative effect of H_2S itself plays an important part here. I take the liberty to suggest that the Research Department of The Institution of Gas Engineers might usefully develop the investigation.

In conclusion, I must express my thanks to the British Aluminium Company for the data and help so willingly provided for the compilation of these few remarks, and to you, Mr. President, and Members of Council, for the opportunity of placing them before the meeting.

Appendix

DETERMINATION OF ACTIVITY OF AN OXIDE.

The apparatus consists of tar scrubber, heat interchanger, humidifier, calibrated stopcock, fouling tower, H_2S detector, containing 5% solution lead acetate, flow meter.

Method.

A foul gas supply is laid on to the apparatus through the tower scrubber, where traces of tar are removed. The H_2S

concentration of the supply is periodically checked up by spot testing. The foul gas supply then passes to the heat interchanger, where the gas temperature is varied over a wide range. The humidifier ensures the gas going forward in a saturated state to the fouling tower. In the latter the gas passes downwards through the oxide sample under test to the H_2S detector. The flow meter measures the rate of gas flow through the apparatus, which in turn is controlled by the calibrated cock between the heat interchanger and the fouling tower.

A test is carried out on the following lines:

The flow meter is first calibrated to measure rates of flow from zero up to 20 cu.ft. per hour. The sample, ground to pass a 30 B.S.S. sieve, is thoroughly mixed with its own bulk of sawdust, and the whole damped to the humidity required. The fouling tower is then charged, first with a 1 in. layer of prepared sawdust, then 3½ in. of the sample, covered by a 1 in. layer of silver sand. This arrangement was found most suitable to facilitate even fouling, but care should be taken to see that the oxide and the sawdust of the sample do not stratify on filling. A few c.c. of a 5% solution of lead acetate are added to the H_2S detector, and the apparatus connected up as in sketch. The foul gas supply is then turned on to pass through the apparatus at approximately 0.5 cu.ft. per hour, until visible signs of the oxide "picking up" are noticed. Meanwhile, the gas temperature is adjusted at the heat interchanger. On reaching the predetermined temperature the rate of flow of the gas stream is increased by distinct stages until the H_2S is detected passing the sample. At this point the rate of flow is noted, and the experiment repeated. The activity rates at the various working temperatures are then recorded, and plotted to give the activity curve of the oxide under test.

SOME OBSERVATIONS ON POLICY*

by

A. B. MUNRO,

of Edinburgh

It has generally been agreed that Gas Service means primarily the sale of gas, and that the selling of appliances has been a means to an end. Since we have reached a stage in the war effort when materials are practically not now available for the manufacture of gas consuming appliances the opportunity may be taken to examine the results obtained from our previous efforts to develop a market and from our search abstract those factors which have been beneficial and might readily be resorted to when the days of normal commerce again return.

In the post war period of the 1914-18 War we were made to realize that a valuable load was available if only we could keep abreast of the general demand to improve kitchen technique and arrangement. The efforts of the cooking appliance manufacturers made it easy for us to maintain and increase the cooking load and by the introduction of easy payment systems extending over a period of years the gas consuming public were attracted to the idea of investing in and owning gas cooking apparatus. It was a revolutionary change over from the general practice in Scotland at anyrate, that the gas authority should supply the cooking apparatus free of charge.

Hire Purchase

1. Cooking

Some undertakings still have doubts regarding the success of a payment by instalment policy. Fears are entertained regarding the number of broken agreements that may be created and of the difficulties associated with the disposal of used appliances. The following figures relate the results obtained from the introduction of hire purchase in Edinburgh. In studying these figures may I remind you that until six months ago a standard pattern cooker was offered on free loan by the Department to all its consumers.

COOKERS ON HIRE PURCHASE.

Years.	3.	5.	10.	Total.
1924/34 ...	346	3,048	298	3,692
1934/35 ...	—	1,341	2,159	3,500
1935/36 ...	—	1,367	3,788	5,155
1936/37 ...	—	1,341	3,984	5,325
1937/38 ...	168	1,024	2,506	3,698
1938/39 ...	628	1,343	2,155	4,126
1939/40 ...	864	990	417	2,271
	2,006	10,454	15,307	27,767

During the above period fully 24,000 cookers were sold for cash.

COOKERS RETURNED FROM HIRE PURCHASE.

1924/34 ...	14	185	—	199
1934/35 ...	—	66	9	75
1935/36 ...	—	101	50	151
1936/37 ...	—	119	78	197
1937/38 ...	—	158	99	257
1938/39 ...	6	125	197	328
1939/40 ...	15	116	365	496
	35	870	798	1,703
Percentage returns	1.7	8.3	5.2	6.1
Percentage returns (excludg. 1939/40)	1.8	8.0	2.9	4.7

It has been an easy matter for us to find a market for these returned appliances. Our workshops are well equipped for reconditioning appliances and a profitable business results from selling such cookers or even offering them on a five years' hire purchase plan. Incidentally one observes in the reconditioning process the enamel finishes best able to withstand the hard wear of a long period of years, and such experience is useful as an aid to deciding which are the best cookers to offer to consumers. From the figures given it must be concluded that a public utility undertaking runs no risk in operating an easy payment scheme, and since modern gas cooking apparatus requires less maintenance than pre-1910 types did, not only does the consumer enjoy better facilities but it costs the undertaking less to provide the better job; and further, if we want the public to realize that the Gas Industry is progressive, what better method is there than by making full use of this practical example? As a war measure the policy since October last has been one whereby a consumer desirous of obtaining a new cooker has had to make an initial payment approximating to one-third of the selling price of the appliance, the balance being spread over a period of three years. Needless to say none of the appliances disposed of under this scheme has been returned.

2. Heating

Gas fires are offered on sale, hire purchase, and simple hire. Builders are encouraged to fix supply pipes in all new houses and allowances by way of a decrease on the service pipe charges are granted according to the number of points fixed. This policy must be encouraged since it has become a habit with builders to fix electric plugs in every room in their new houses. However, one must be careful to qualify the condition of such an allowance by stating that payment will only be made when the Department is satisfied that satisfactory flues have been provided. It appears to be taken for granted in the building industry that any exhaust arrangement is good enough for gas appliances. While gas has a very great sales value as a heating agent we must not overlook the important contribution its use makes to improving health standards by aiding ventilation. The Ministry of Health has an idea that if two flues are provided per house sufficient ventilation is provided therein. If that be correct then why do so many of the householders resident in the new housing estates express their annoyance at the stuffiness of their homes and appear disgruntled when they learn that the lack of flues prevents them from enjoying a gas heating service? In older property we continue to encourage the fixing of all piping under floors, aware of the fact that some business is lost because not every housewife is prepared to consent to the inconvenience such fixing creates. While on the subject of piping it is gratifying to remark that we are slowly passing from the composition age and are now making greater use of iron and copper pipes. Our records of fire installations show that in the last ten years we fixed 7,759 on sale, 10,206 on hire purchase, and 5,221 on simple hire.

3. Water Heating

Now a market for future development must be found in the water heating business. Our competitors think that this is their business, but I am of the opinion that it is a job which gas alone can do well. The following figures are the results storage heaters are offered on simple hire terms, the rental approximating to one-sixth of the cost price of the appliance.

* Paper prepared for the Annual General Meeting of the North British Association of Gas Managers.

This rental charge includes for a certain sum to cover part of the installation charges. The gas supply is offered on a daily contract rate, varying according to the storage capacity of the appliance supplied. Circulators are also offered on simple hire and with each installation a heat insulation jacket is provided. With regard to fixing, the rental rate also includes a certain allowance towards the installation charges. With every installation the consumer must pay an initial payment obtained in the first 20 installations of each of the following types of heater fixed in Edinburgh:

Type of Heater.	Consumption per Annum. Minimum.	Maximum.	Average
A Sink Heater	4,800 cu. ft. (22.8 therms)	88,000 cu. ft. (418 therms)	20,000 cu.ft. (95 therms).
B. Multipoint	10,200 cu. ft. (48.45 therms	150,200 cu. ft. (713.45 therms)	78,200 cu. ft. (371.45 therms)
C. Low consumption storage	19,000 cu. ft. (90.25 therms)	119,000 cu. ft. (565.25 therms)	66,000 cu. ft. (313.5 therms)
D. Circulator	8,900 cu. ft. (42.275 therms)	106,000 cu. ft. (503.5 therms)	44,100 cu. ft. (209.5 therms)

The first two types of these are offered for cash or on hire purchase terms only. When sold for cash the consumer must pay all installation charges, the Department enlarging the service pipe and the meter free of charge. Low consumption of 20s., together with the difference in the amount of the plumber's estimate and the amount the Department is prepared to expend on the job. Some may consider this policy as being too conservative. The following figures show the results obtained:

Year.	Water Heaters. Hire.	Hire purchase.	Sold.	Total.
1932/33 ...	—	10	147	157
1933/34 ...	81	13	136	230
1934/35 ...	99	19	197	315
1935/36 ...	153	27	290	470
1936/37 ...	145	41	322	508
1937/38 ...	132	161	352	645
1938/39 ...	160	177	398	735
1939/40 ...	164	98	332	594
	934	546	2,174	3,654

Observations tend to confirm the soundness of the gas contract rate. In several installations we fitted meters so that we could ascertain the price per thousand received and it averaged 2s. as against a standard price of 2s. 3½d. had the gas been purchased at ordinary rates. With a "contract" rate the customer knows exactly how much she is going to pay for a hot water service the quantity of which is guaranteed. And this type of business has a goodwill value which no amount of Press advertising can create. We have records of consumers who, satisfied with their bargain, have introduced no fewer than 15 of their friends in one instance and 12 in another to this class of business. Circulators afford us particularly good business because their installation leaves the consumer with the alternative of using smokeless solid fuel in the colder period of the year when solid fuel firing is made more necessary in our northern climate. We are all aware of the common belief that with a back or range boiler hot water can be obtained for nothing. The demand for hot water and for heat for other purposes do not always coincide—as a consideration of winter and summer conditions alone will indicate. It's up to us then to expose the absurdity of this common fallacy of obtaining heat for nothing. It has often been argued that gas as a fuel for hot water supply has a limited market and that business can only be found in that section of the community where incomes are relatively large. Recent investigations prove that notion to be wrong, and since water-heating offers a field for greater load building than either the cooking or space heating business I submit that we can go forward with a tariff scheme assured of its success if only we can get attractive price rates.

Rate Charges for Gas

How should such charges be arranged? Have the rates to be according to the size and number of premises, the assessable value, the size of meter or service pipe, or the load factor? Either scheme offers a part solution to the problem but all of them are limited in their scope, and I venture to suggest that the greatest success will be realized from the introduction of a "block" scheme coupled with the size of house. The first block must be so priced that immediately it is used the consumer can enjoy the remainder of the gas demand at half price. Further reductions may be available for industrialists but their initial block must vary according to the size of service pipe and their load factor. A "block" system was introduced in Edinburgh some years ago and its only criticism has come from small industrialists who previously enjoyed a "trade" rate even though their value as consumers was in many instances less than many of our domestic consumers.

Industrial Load

With gas at almost half price for large quantity sales the present system has attracted large industrialists and we have experienced an increasing demand among the baking and catering trades. One new consumer, in the sanitary ware trade, has required 70 million cu.ft. (332,500 therms) per annum and the load is taken at an even hourly rate. A temperature of 1,200° C. is required for the firing of the glaze used in the fireclay trade. In our preliminary investigations the works owner informed us that we would require to melt a No. 9 Segar cone to meet his requirements. The furnace is 422 ft. long, and has 72 burners staggered throughout its length, 56 of these being concentrated in that section known as the firing zone. The walls vary in thickness from 30 in. to 44 in. In our earlier tests it was soon realized that difficulties were created by the distortion of the cast iron burner heads. Experiments with fireclay nozzles were carried through and it was found that these gave general satisfaction when the gas air mixture was allowed to issue from a slot in the burner head measuring 6 in. long by ½ in. wide. The mixing chambers were changed from wrought iron tubes to fireclay also, and as the supply was governed the correct positioning of the injectors was a simple matter. As producer gas had been used in the plant previous to our experiments it was very necessary that we should be able to show that town gas provided better facilities for easier operation and that savings could be effected. Close attention had to be given to the exhaust machinery. Many fan speeds were tried before it was finally decided to run the plant with a "pull" of 0.6 in. The flue gases showed a high percentage of 0_2. With a gas pressure of 2 in. the plant has operated successfully and continuously for a period of 21 months. The goods are placed on trucks and the kiln holds 57 of these. Each truck is loaded with from 4 to 20 pieces according to the size and weight of the tubs and sinks, &c., which vary in weight from 12 to 260 lb. The truck takes fully seven days to travel the length of the kiln. As a truck enters the kiln the goods on it are in a moist condition and in its movement towards the cooking chamber the heats are slowly increasing. By the time the truck enters the high temperature zone (which measures 50 ft.) the first cone—a No. 7—should be showing signs of melting. Only a few burners are in use between the high temperature zone and the outlet of the kiln.

After cooling, the goods are removed to the yard for "weathering" and it is during this period that the faults are discovered. Heavy rain or a night's frost will cause any weak part of the enamel to disintegrate. The steady heat of the gas kiln has been responsible for fewer throw-outs than even result from muffle firing. In regard to finish one would expect that exposure to direct firing would dull the lustre of the enamels. This does not happen. It is impossible for an expert to select a piece in these works and say with any assurance that it came from either the muffle or the gas kiln.

With regard to running charges the cost for gas per week amounts to £93, against a weekly charge of £86 13s. 6d. when producer gas was used. Since the number of throw-outs was negligible when town gas was being used there was a satisfactory saving, because owing to the difficulty of maintaining heats with the producer gas plant in use the percentage of waste was great.

Service

One of the many problems within our Industry is associated with the need for constant attention to consumers' appliances. A recent investigation into the performance of cookers fitted with governors showed that the first 200 of these appliances installed in our area did not create a consumer's request for attention over a period of two years. An examination of the governor diaphragms indicated that these would be the better of cleaning and oiling at least once per annum. A similar number of old pattern cookers fitted for a like period (two years) produced 15% requests for service. Now if you want to make the most of the opportunity which consumer contact affords for selling more, then there is a lesson in that investigation for all of us. It is easier to sell when you are volunteering a service rather than when you are conscripted to it. It has been my policy for many years now to encourage the establishment of a training centre for our gas fitting staffs. That such training is necessary has already been proved by the makers of modern gas consuming apparatus and by the London & Southern Gas Companies. We in Scotland are made up as a community of small units. None of us ever has

the opportunity to deal with every type of installation work, but with a training centre available we should be certain that our fitters would be capable of dealing with any and every type of appliance which might be entrusted to them for fixing. How many of our distribution sections have considered the building up of a kit of modern tools best suited to the needs of our apparatus? That such a kit is necessary in an age of chromium finish and micrometer measuring must be obvious to all, for your present-day fitter requires to be more of a mechanic than a plumber, since his work is largely associated with cleaning and regulating finely adjusted appliances.

Co-ordination

One other factor must also be referred to in these notes. In our trading efforts in Scotland each undertaking has its own method of arriving at selling, hire purchase, and simple hire rates, with the result that one finds that the public are rather suspicious of having to pay more in some areas than in others for the same goods. Cannot we establish a regional committee to investigate the possibility of standard prices? If the large buyer is able to get more advantageous rates from his suppliers no doubt he spends more in marketing than does the smaller undertaking which has to be content with the minimum discount on his purchases. Such a scheme would also help to make the hire purchase transfer scheme more general than it meantime is. While dealing with standard selling prices it will be obvious to all that the canvasser salesman's job would be more easily worked and would produce better results if prices were common throughout Scotland. Incidentally it occurs to me that a staff of such salesmen could be employed regularly within the Scottish Industry and hired out to those desirous of developing an aggressive sales policy.

Home Service

And now a word about Home Service. The employment of women demonstrators does not seem to be popular in the North. It may be that we consider Scots housewives are too independent to take advantage of any service such demonstrators can offer them. It is just such an assumption that has made the canned food industry so successful. It is not enough for us merely to arrange an occasional demonstration of small dishes in the hope that a few cooker sales will result from the effort. A good Home Service demonstrator should be able to make contacts with every useful Association in the area—the Women's Rural Association, the Townswomen's Guild, the Women's Voluntary Services, the Education Authority cookery teachers, the women Press representatives, the Public Health Authorities, and the Church Organizations. In Edinburgh we have just completed a series of fruit bottling demonstrations in conjunction with the W.V.S., and thanks to their assistance we were able to get much good publicity for gas free of charge, and our audiences exceeded 7,000. Our next venture with the same association will be on a war food campaign. Last autumn we co-operated with the Public Health Authorities in demonstrating to audiences in the poorest parts of the city and produced a booklet showing the best foods to eat on a limited income. Every article used in the demonstrations was priced according to our list, and useful pioneering work was done for the Health Authorities and GAS.

These notes have been prepared at the invitation of your President, who requested that I be concise and informative, in the hope that a vigorous discussion would follow. I would express my indebtedness to Mr. Jamieson for his permission to quote from the records and figures of the Edinburgh Gas Department.

PLASTIC PROPERTIES OF BITUMINOUS COKING COALS*

From *Industrial and Engineering Chemistry*

By
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FOR many years it was generally believed that the coking properties of bituminous coals were affected deleteriously by oxidation. More recently, however, it has been established (*7, 9, 10*) that some high-volatile A coals which develop a high degree of fluidity during carbonization show improved coking characteristics after oxidation has progressed to a certain stage peculiar to each coal. Controlled oxidation, therefore, has found economic applications in the reduction of the fluidity of such coals to give more desirable products in several low-temperature carbonization and coal-processing methods and in coking plants. Furthermore, limited oxidation has been found to reduce the dangerous expansion properties of low and medium volatile coals.

The tendency of different coals to oxidize at ordinary temperatures has been measured in a number of different ways. Among these evaluation tests for determining the extent of oxidation at any given stage, proximate and ultimate analyses, the agglutinating number of caking index, carbonization followed by shatter and tumbler tests on the resulting coke, temperature measurements in and composition of the gaseous products evolved from the stored-coal pile, and determination of plastic properties have found wide application. Since many coals often tend to oxidize slowly at ordinary temperatures accelerated oxidation tests have been devised to produce samples for evaluation of the extent of oxidation by the above-mentioned tests.

Mechanism of Coal Oxidation

The oxidation of coal is attributed to the addition of oxygen and therewith to the oxidation of certain coal constituents. All coals, even anthracites, combine with oxygen with the generation of heat. If this heat is not dissipated, spontaneous combustion may result. The "absorption" of oxygen by coal begins as soon as it is broken out from the mine, and is most rapid with freshly mined coal. The extent of oxidation of a given coal depends on a number of factors. These factors are summarized and discussed in earlier investigations (*2, 5, 6*). Davis and Reynolds (*5*) and Bone and Himus (*2*) give excellent reviews of both the older iron pyrites and of the present coal-oxygen complex theory of oxidation of coals. The latter theory attributes oxidation mainly to the presence in the coal substance of "unsaturated" compounds, which are oxidized more or less readily according to their constitution to form compounds of the humic acid type. During the process the oxygen is first "absorbed" by the coal substance, possibly in some activated form, then is more or less loosely incorporated with it in some way to form an unstable "oxygenated" compound or compounds, which with increased temperature decompose into carbon dioxide, carbon monoxide, and water. The net result, therefore, is a four-way distribution of the oxygen into oxygenated coal (residue), carbon dioxide, carbon monoxide, and water whose relative proportions depend on the conditions of oxidation.

The known facts about the mechanism of oxidation of coals have a close parallel, at least physically, with corresponding changes in plastic properties. The reductions in fluidity and in expansion of bituminous coking coals caused by pre-oxidation have been attributed to the destruction of any excess of the binding constituents over that required to give a strong semicoke. The same effect can be produced by the proper blending of coals of different types or by addition of inerts or, alternately by preheating the coal to a temperature somewhat under 400° C for a suitable time. Undoubtedly, the chemical changes are not the same, but the net physical effects appear to be similar.

Apparatus and Test Procedures

The accelerated oxidation method developed in this laboratory (*9*) has been extended for tests at higher temperatures (*8*). In the latter test procedure the coal is oxidized for various selected periods in air at 99.3° C. Samples representative of these different stages of oxidation were removed for test. The effect of the progressive increase in oxidation in the six different coal series upon the plastic characteristics of the original fresh coals was determined. Comparative data on both the fresh and oxidized samples in their preplastic and plastic temperature ranges were obtained by the Agde-Damm dilatometer and the Gieseler and Davis plastometer test methods (*3, 4*).

The preplastic range of coal begins with the initial softening temperature as indicated by the Agde-Damm dilatometer and the Gieseler plastometer and ends with the fusion temperature as given by the Agde-Damm dilatometer and the Gieseler and Davis plastometer test methods. The plastic range is covered by the temperature interval between fusion and the end of the plastic range as determined by the Gieseler and Davis plastometers. The Gieseler plastometer shows the variations in fluidity of the coal throughout both its preplastic and plastic temperature ranges. For very fluid coals, the Davis plastometer indicates a "minimum resistance" (maximum fluidity) over a relatively long temperature range. The

* Paper to the Division of Gas and Fuel Chemistry at the 98th Meeting of the American Chemical Society, Boston.

TABLE I. ANALYSES OF COALS, AS-RECEIVED BASIS.

Coal No.	Description.	Days of Oxidation in Air at 99.3° C.	Dry, Mineral-Matter-Free, Fixed C, %	Proximate, % Moisture.	Volatile matter.	Fixed C.	Ultimate, % Ash.	H	C	N	O	S	Heating Value B.Th.U./lb.	Cal./gramme.
54	High Splint bed, Closplint mine ...	—	59.9	3.3	37.5	55.5	3.7	5.5	78.3	1.4	10.6	0.5	13,870	7,706
54-2-Ox		3.0	61.3	1.2	37.0	57.9	3.9	5.4	79.1	1.4	9.7	0.5	14,010	7,783
54-3-Ox		5.95	61.8	1.7	36.3	57.9	4.1	5.4	78.3	1.3	10.1	0.8	13,920	7,733
54-4-Ox		9.88	61.4	1.2	36.9	57.9	4.0	5.3	78.6	1.4	10.1	0.6	13,890	7,717
C-1	Pittsburgh bed, Bruceton mine ...	—	60.7	2.4	35.7	53.6	8.3	5.3	75.2	1.5	8.1	1.6	13,450	7,472
C-9		5.12	62.5	0.8	34.5	55.8	8.9	5.1	75.5	1.4	7.6	1.5	13,490	7,494
C-10		8.08	62.1	0.9	35.0	55.8	8.3	5.1	75.8	1.5	7.8	1.5	13,550	7,528
C-11		12.02	63.1	0.9	34.1	56.6	8.4	5.1	75.7	1.4	7.9	1.5	13,460	7,478
C-13		16.02	63.2	1.0	34.0	56.6	8.4	5.1	75.3	1.5	8.3	1.4	13,390	7,439
C-12		23.92	63.1	1.0	34.1	56.7	8.2	5.0	75.1	1.4	8.8	1.5	13,320	7,400
53	Pond Creek bed, Majestic mine ...	—	66.1	2.7	31.9	61.1	4.3	5.3	80.5	1.5	7.7	0.7	14,290	7,939
53-3Ox		4.10	66.5	0.8	32.0	62.6	4.6	5.2	81.2	1.5	6.8	0.7	14,400	8,000
53-4-Ox		8.23	66.6	0.9	31.9	62.7	4.5	5.2	80.9	1.5	7.2	0.7	14,370	7,983
53-5-Ox		13.21	66.6	0.9	31.9	62.7	4.5	5.2	80.8	1.5	7.3	0.7	14,300	7,944
65	Sewell bed, Wyoming mine	—	77.5	1.6	21.8	73.7	2.9	4.9	85.8	1.4	4.3	0.7	14,950	8,306
55-2-Ox		5.62	77.8	1.3	21.5	74.2	3.0	4.8	85.3	1.5	4.7	0.7	14,850	8,250
55-3-Ox		18.79	78.4	1.7	20.9	74.4	3.0	4.7	85.2	1.5	4.9	0.7	14,690	8,161
56	Pocahontas No. 3 bed, Buckeye No. 3 mine	—	81.7	1.6	17.4	74.5	6.5	4.4	83.7	1.2	3.6	0.6	14,400	8,000
56-1-Ox		3.97	82.5	1.2	16.8	75.7	6.3	4.4	84.2	1.2	3.3	0.6	14,450	8,028
56-2-Ox		11.81	81.7	0.9	17.5	75.1	6.5	4.3	83.3	1.2	4.0	0.7	14,370	7,983
57	Pocahontas No. 4 bed, No. 4 mine ...	—	83.3	1.4	16.0	75.6	7.0	4.3	82.6	1.3	3.7	1.1	14,300	7,944
57-1-aOx		0.56	82.9	1.2	16.4	75.5	6.9	4.4	83.1	1.2	3.4	1.0	14,400	8,000
57-2-aOx		3.56	82.7	1.5	16.5	75.2	6.8	4.4	82.3	1.2	4.3	1.0	14,300	7,944
57-1-Ox		6.00	83.2	0.9	16.2	76.3	6.6	4.4	84.0	1.3	2.7	1.0	14,410	8,006
57-3-aOx		6.56	83.1	1.3	16.2	75.7	6.8	4.3	82.6	1.3	3.9	1.1	14,290	7,939
57-2-Ox		9.44	83.1	0.9	16.3	76.1	6.7	4.1	83.4	1.3	3.4	1.1	14,320	7,956

actual variations in the degree of fluidity in this temperature range are best shown by the Gieseler plastometer curve. The Davis plastometer measures the resistance developed by the coal up to the time that semicoke formation is complete. On this account, as shown previously (*4*), the Davis plastometer indicates the end of the plastic range at a higher temperature than that given by the Gieseler plastometer, whose stirring shaft shows no further movement after re-solidification of the heated coal into semicoke.

Description of Coals Tested

Table I gives the rank (*1*) (dry, mineral-matter-free fixed carbon content), the proximate and ultimate analyses, and the heating values of the six coals and of the twenty oxidized samples. The unoxidized High Splint, Pond Creek, Sewell, Pocahontas No. 3, and Pocahontas No. 4 bed coals were tested in the Bureau of Mines—American Gas Association (BM-AGA) survey of American coals and bear the same serial numbers assigned in those tests. The unoxidized Pittsburg bed, Bruceton mine, coal C-1 is a second mine sample of the coal designated as No. 52 in the survey. The oxidized samples used in the present work were prepared from these six unoxidized coals under the oxidation conditions summarized in the table. In the "aOx" series of coal 57 (Pocahontas No. 4 bed), coal 57-1-aOx was first oxidized for six days in air at 23° C. After a portion of coal 57-1-aOx was removed for test, the remainder was then oxidized further at 99.3° C. to give coals 57-2-aOx and 57-3-aOx. The times of oxidation in the table represent the six days of oxidation at 23° C., computed to the equivalent time at 99.3° C., plus any time of additional oxidation at 99.3° C. (*8*). The coals selected for this study cover a wide range of coals of bituminous rank. Three of them are of high-volatile A rank (*1*). Coal 54 is a splint coal from the High Splint bed. Coal C, Pittsburgh bed, and coal 53, Pond Creek bed, are fusible bright coals. Coal 55, Sewell bed, is high in the medium-volatile bituminous rank. It fuses well, but shows expanding properties. Coal 56, Pocahontas No. 3 bed, and coal 57, Pocahontas No. 4 bed, are low-volatile bituminous coals. Coal 57 is slightly higher in rank than coal 56. If the heating rate is high enough, both coals produce strong cokes. They also have dangerous expanding characteristics.

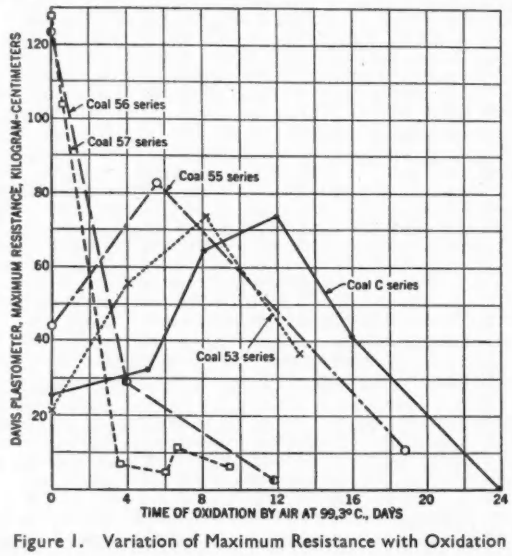


Figure 1. Variation of Maximum Resistance with Oxidation

Effect of Oxidation on Plastic Properties

Table II gives the results of the Agde-Damm dilatometer and the Gieseler and Davis plastometer tests. The data show the effect of oxidation on three high-volatile A, one medium-volatile, and two low-volatile bituminous coals, and twenty oxidized samples of these coals.

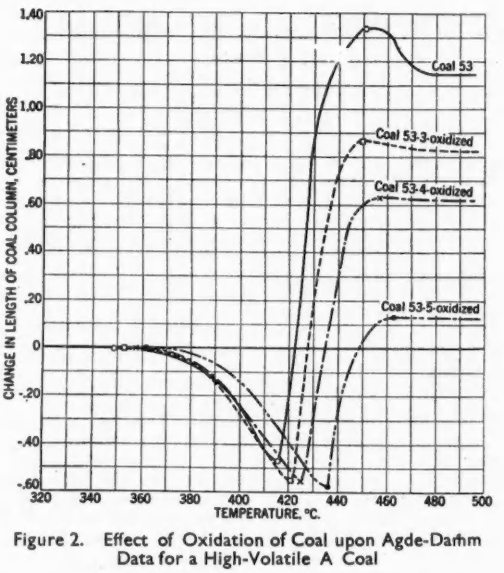


Figure 2. Effect of Oxidation of Coal upon Agde-Damm Data for a High-Volatile A Coal

The low-rank, high-volatile-A, High Splint bed coal contains 53 area % of splint coal. It develops low fluidity and low resistance in the plastometer tests. This property is characteristic of high-volatile A coals of this type. The most marked effect of oxidation of this coal is shown by increases in the characteristic Agde-Damm temperatures of the first oxidation sample. Further oxidation raises the initial contraction temperature slightly, but no initial and final expansions are shown. The oxidized samples fuse so poorly that no resistance is developed in the Davis plastometer.

A sample of coal from the Pittsburgh bed, Bruceton mine, designated here as coal C-1, was oxidized extensively. This coal is of high-volatile A rank and shows high fluidity. Upon oxidation, the temperatures of initial contraction and expansion in the Agde-Damm test and that at which resistance develops in the Davis plastometer test are raised progressively. As indicated by the Davis plastometer test, the plastic temperature range is shortened with increased oxidation. Oxidation tends to raise the rank of a coal artificially. In the case of the C series, the dry, mineral-matter-free fixed-carbon content increases from 60.7% for

TABLE II.—Comparison of Agde-Damm, Gieseler, and Davis Test Data on Coals Oxidized by Air at 99.3° C.

Coal No.	Dry, Mineral-Matter-Free, Fixed C. %	Agde-Damm Free Swelling Coefficient [a]	Initial Softening Temp., °C. — Agde-Damm dilatometer, initial contraction temp.	Gieseler plastometer, at 0.1 dial division.	Fusion Temp., °C. — Agde-Damm dilatometer, initial expansion temp.	Gieseler plastometer, at 5.0 dial div. per min.	Davis plastometer, resistance develops	Agde-Damm dilatometer, final expansion temp., °C.	Max Fluidity — Gieseler Plastometer, Max. Pointer Movement. Temp., °C.	Div. per min.	Davis Plastometer, Min. Resistance. Temp., °C.	Kg.-cm.	Gieseler plastometer, at 5.0 dial div. per min., °C.	Davis Plastometer, Max. Resistance. Temp., °C.	Kg.-cm.	End of Plastic Range. Gieseler plastometer, °C.	Davis plastometer, °C.
54	59.9	1.0	352	356	414	394	410	424	426	6	443	0.2	439	456	10.9	445	474
54-2-Ox	61.3	1.0	362		440		c	452	c		c	c		c	c		c
54-3-Ox	61.8	1.0	365		b		c	b	c		c	c		c	c		c
54-4-Ox	61.4	1.0	365		b		c	b	c		c	c		c	c		c
C-1	60.7	1.6–1.8	331	334	403	413	400	431	436	706	432	0.3	462	468	25.9	470	478
C-9	62.5	1.0–1.1	334		408		410	439			439	1.7		462	32.3		483
C-10	62.1	0.9–1.1	340		418		415	443			430	0.8		468	64.5		486
C-11	63.1	0.8–0.9	345		423		420	450			432	0.6		467	73.7		487
C-13	63.2	0.8	349		427		424	462			436	1.2		466	41.5		491
C-12	63.1	0.8–0.9	355		443		447	452			—	—		460	0.6		465
53	66.1	1.3–1.4	349	348	416	405	410	451	429	1,250	424	0.6	461	477	21.3	462	491
53-3-Ox	66.5	0.8–1.0	353		421		420	449			447	0		473	55.3		493
53-4-Ox	66.6	1.0	358		425		427	457			443	0		470	73.7		500
53-5-Ox	66.6	0.8–1.0	362		436		441	463			450	0		471	36.9		498
55	77.5	1.5	387	386	433	435	433	472	461	89	472	3.5	482	494	43.8	494	508
55-2-Ox	77.8	0.8–1.0	396	397	448	453	451	490	462	12	462	0	475	493	82.9	491	511
55-3-Ox	78.4	1.0	406	402	b	d	472	b	457	0.5	—	—	d	497	10.9	488	509
56	81.7	0.9	423	416	465	463	460	e	476	18	475	4.6	490	508	123.3	505	520
56-1-Ox	82.5	0.9	419	412	476	d	499	c	475	3	504	6.9	d	515	28.8	497	525
56-2-Ox	81.7	1.0	427	418	b	d	500	b	467	0.8	536	0.5	d	545	2.6	504	551
57	83.3	0.9	428	423	466	d	473	e	479	3	482	19.0	d	505	127.9	498	520
57-1-aOx	82.9	0.9	435	435	474	d	474	496	485	4.7	—	—	504 f	506	103.7	512	525
57-2-aOx	82.7	0.9	436	434	b	d	489	b	474	1.2	501	0.1	d	506	6.9	506	528
57-1-Ox	83.2	1.0	435	422	b	d	495	b	462	0.9	508	1.2	d	536	4.6	501	532
57-3-aOx	83.1	0.9	436	435	b	d	500	b	468	0.7	—	—	d	537	11.5	502	549
57-2-Ox	83.1	1.0	440	432	b	d	502	b	458	0.3	517	0.3	d	544	6.1	491	562

[a] Second figure includes mushroom-shaped cap. [b] Still contracting at 500° C. [c] No resistance. [d] Not evaluated; no sharp point of inflection. [e] Still expanding at 500° C.
[f] Owing to the low fluidity, solidification temperature is taken at 0.5 dial division per minute.

C-1 to 63.1% for C-11. Correspondingly, the Davis plastometer maximum resistance value increases from 25.9 kg.-cm. for C-1 to

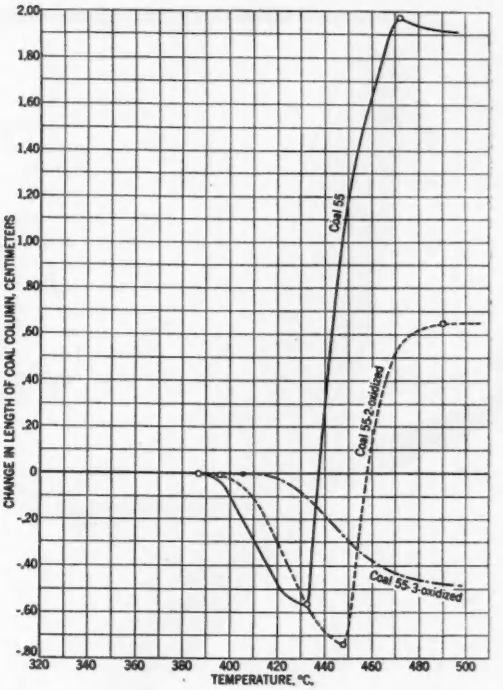


Figure 3. Effect of Oxidation of Coal upon Agde-Damm Test Data for a Medium-Volatile Coal

73.7 kg.-cm. for C-11. Additional oxidation has no appreciable effect on the fixed-carbon content of the coal, but the maximum resistance is reduced. Fig. 1 shows the maximum resistances plotted against the times of oxidation for the coals of the C series and of four other series. In each series the coal that showed the highest maximum resistance also produced the strongest coke (*10*). Past experience in this laboratory showed that this relation between Davis plastometer maximum resistance and coke strength holds generally. The oxidized samples of High Splint bed coal showed no resistance and hence could not be represented.

Coal 53, Pond Creek bed, ranks high in the high-volatile A bituminous class. It has high fluidity and develops moderate resistance. The rank of this coal is increased slightly by oxidation. The Agde-Damm initial contraction temperature and the fusion temperatures determined by the Agde-Damm dilatometer and Davis plastometer tests are raised with oxidation. Fig. 2 shows the Agde-Damm curves for the four coals of the Ponk Creek series with their designated characteristic temperature points. The family of curves indicates that the expansion of the coal is progressively decreased with increased oxidation. The maximum resistances obtained by the Davis plastometer in the Ponk Creek series for the first three samples increase with further oxidation

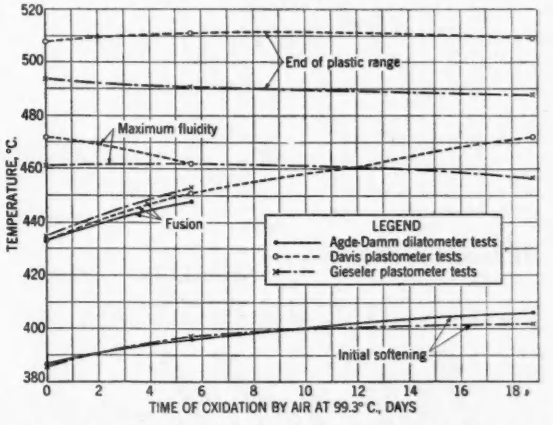
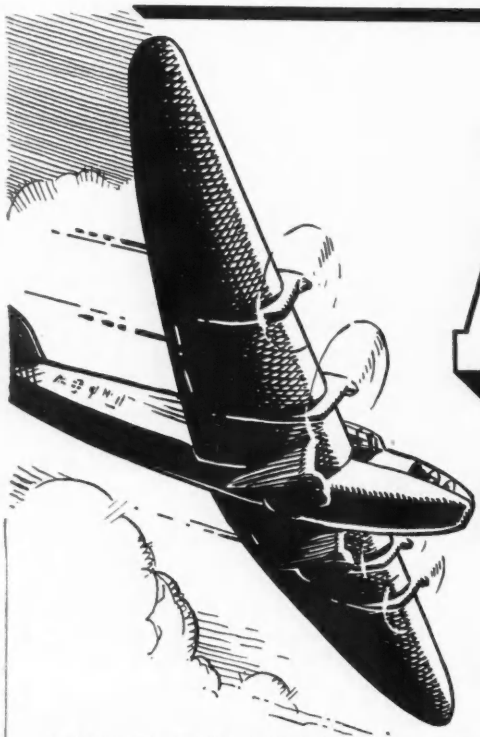


Figure 4. Variation of Characteristic Temperatures in the Preplastic and Plastic Ranges with Oxidation for Coal 55 Series

and then fall. The plastic temperature range tends to be shortened with oxidation of the coals. The unoxidized coal has a plastic range of 81° C., whereas the most oxidized coal shows a range of only 57° C.



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Coal 55, Sewell bed, is high in the medium-volatile range of rank of bituminous coals. Table II shows that the Agde-Damm initial contraction temperatures are raised with increased oxidation of the samples in this series. The first oxidation sample also gives increases in the Agde-Damm initial and final expansion temperatures. The second oxidized sample does not show these temperature points but only a contraction throughout the test. Fig. 3 illustrates these changes graphically. Table II shows further that the initial softening temperatures by the Gieseler plastometer test and the fusion temperatures by the Gieseler and Davis plastometer tests are in close agreement with the corresponding temperatures of the Agde-Damm test. These temperatures also are raised by increased oxidation of the coal. Fig. 4 shows the most significant temperature points characterizing the plastic properties of the coals of the Sewell bed series plotted against the times of oxidation of these coals. The initial softening and fusion temperatures increase with increasing extent of oxidation. The plastic

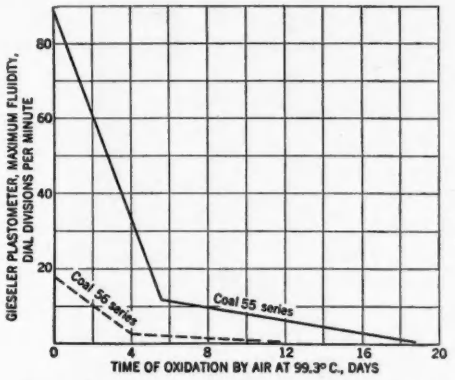

Figure 5. Variation in Maximum Fluidity with Oxidation

temperature ranges determined by the Davis plastometer method are shortened. The maximum fluidity shown by both the Gieseler and Davis plastometer tests is reduced. The reduction in fluidity with increased oxidation in the series is well illustrated in Fig. 5 for the Gieseler test data. This method is more sensitive than the Davis plastometer method to small variations in the fluidity of the two oxidized coals. Fig. 1 shows that the maximum resistances by the Davis method are increased for the first and decreased for the second oxidation sample compared to that for the fresh coal.

Coal 56, Pocahontas No. 3 bed, and coal 57, Pocahontas No. 4 bed, are both of low-volatile bituminous rank. In each series of coals the initial softening temperatures as determined by the Agde-Damm and the Gieseler test methods increase with increased oxidation. Beyond the initial softening temperature, the more severely oxidized samples of these coals continued to contract throughout the Agde-Damm tests. Gieseler plastometer curves for the fresh and oxidized samples of coal 56 are plotted in Fig. 6. The already low fluidity of this coal is reduced measurably by oxidation. Fig. 5 compares the Gieseler plastometer maximum fluidity values for the fresh and oxidized samples of low-volatile bituminous coal 56 (Pocahontas No. 3 bed) with those for the corresponding samples of medium-volatile coal 55 (Sewell bed). The extremely high maximum resistances (Davis plastometer) of the two unoxidized Pocahontas coals are reduced progressively in the oxidized samples. Inspection of the residues in the Davis retort showed well-fused coke from the unoxidized Pocahontas coals. Granular residues, however, were found in the retort for the oxidized samples. The oxidized coals, especially those of the coal 57 series, show considerable resistance in the Davis plastometer. This resistance was produced by adherence of the slightly softened coal particles rather than by their complete fusion and re-solidification. The residue from coal 57-2-Ox contained two types of material. Some of the coal particles had been softened

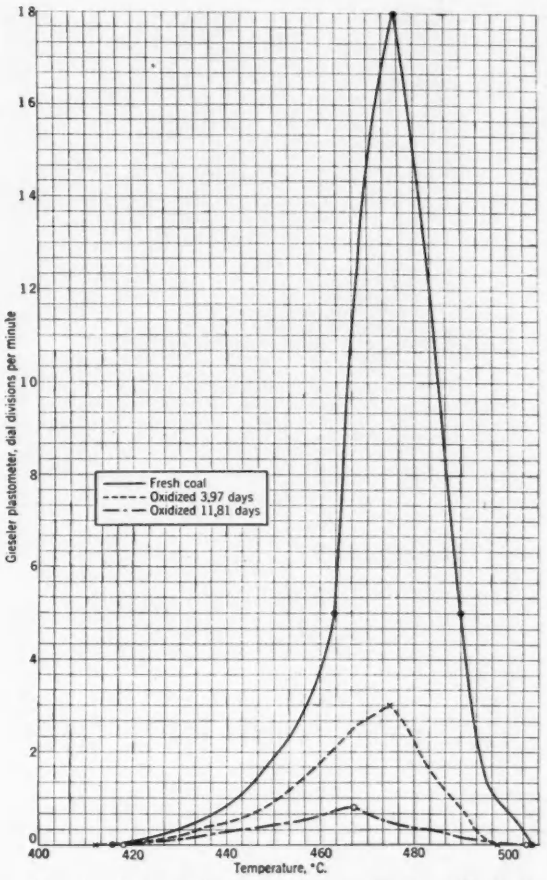

Figure 6. Gieseler Plastometer Curves, Fresh and Oxidized Pocahontas No. 3 Bed Coal

slightly on their surfaces but retained their original shape, whereas others had been fused and remained as hollow spheres.

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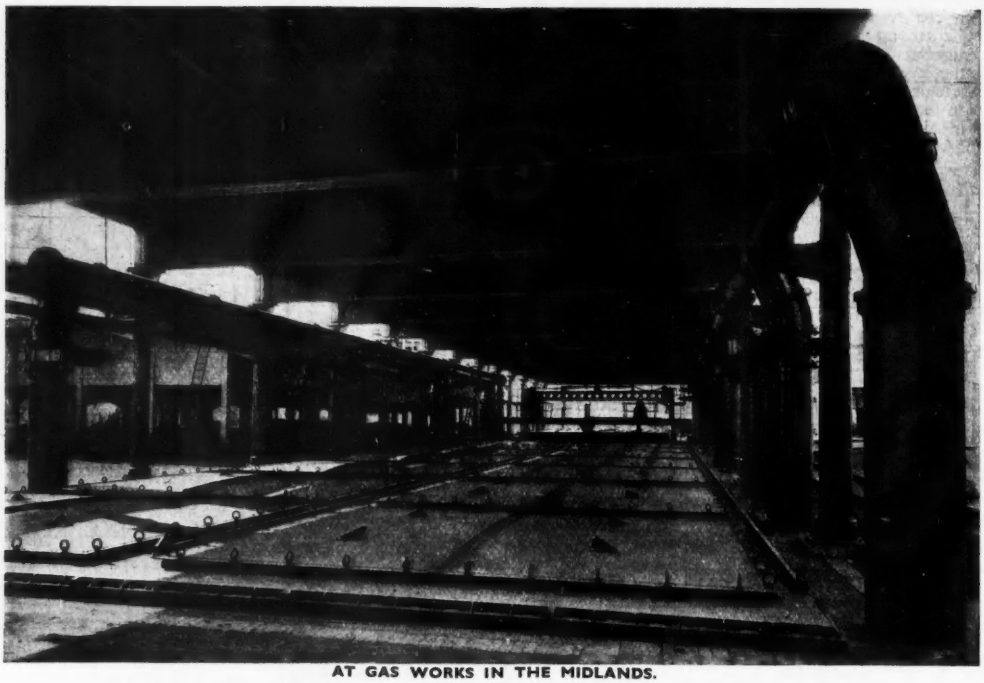
Gas Undertakings' Results

Cork

A record consumption for any half-year in the history of the undertaking was reported at the recent meeting of the Cork Gas Consumers' Company, when the accounts for the six months ended June last were submitted. It was stated that the balance of profit and loss, at £4,443, was sufficient to pay the usual dividend at the rate of 8% per annum and leave a balance of £350 to be added to the Reserve Fund. In the previous half-year it had been necessary to draw upon this fund to the extent of £962. A rise in revenue resulting from an increase in the prices of gas and coke has been more than absorbed by the higher cost of coal. The larger output of gas has been due partly to a greater consumption all round and partly to a further increase in the number of consumers. Additional storage accommodation has been arranged, and the Company have now on the works substantially larger stocks of coal than ever before. "We have," said the Chairman, "been splendidly served all through the year by our suppliers in Great Britain." After twenty years of loyalty and good service to the Company as Secretary, Mr. Richard Healy has been co-opted to a seat on the Board. He has been associated with the Company for the long period of 46 years.

Wesbech

At the half-yearly meeting of the Wisbech Lighting Company, the Directors were in a position to report an increase in the consumption of gas by private consumers to an extent that has more than counterbalanced the loss of revenue from public lighting. Dividends are being paid on the ordinary stock at the rate of 12% per annum, and on the ordinary shares at the rate of 11% per annum. For the purpose of appointing Mr. John Green (Engineer and Manager of the Company) as Managing Director, he has been appointed to a seat on the Board. This is in recognition of the services he has rendered to the Company over a period of 20 years, and the work he has done in efficiently reconstructing the plant. The shareholders approved a recommendation by the Board that £100 be paid to the Mayor's Wisbech Spitfire Fund.



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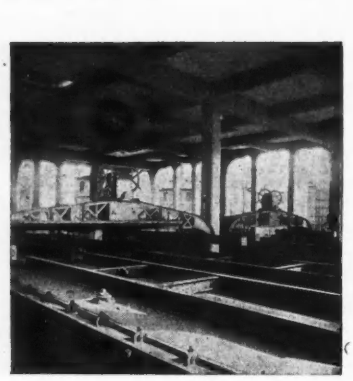

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Gas Products Prices

The London Market

Sept. 9.

There are no changes to record in the values of Tar products in the London market, present values being as under : Pitch remains nominal, creosote is about 4⅜d. to 5d. per gallon, refined tar 3⅜d. to 4d., the price of pure toluene under the Ministry of Supply Toluene No. 2 Order is 2s. 5d. per gallon, pure benzole 1s 10d., 95/160 solvent naphtha 1s. 11d. to 2s. 0d., and 90/160 pyridine about 17s. 6d. all per gallon naked, refined naphthalene crystals £23 per ton in bags, all *ex* Makers' Works.

The Provinces

The average prices of gas-works products during the week were: Pitch and Crude Tar.* Toluole, naked, North, 1s. 9½d. (Controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North 9d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 4½d. to 1s. 5½d. Creosote, *ex* works, in bulk, North liquid and salty, 4½d. to 4¾d.; Scotland, 4½d. to 4¾d.; low gravity, 4½d. to 4¾d. Fuel Grade, 4d. to 4¼d. Carbolic acid, 60's, 3s. 6d. to 3s. 7½d. Naphthalene, £15 to £20. Salts, 75s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal. Heavy oil: Unfiltered anthracene oil, (min. gr. 1,080), 5¼d. to 5½d.; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d.; heavy anthracene oil gr. less than 1,080, 6d. to 6¼d.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note in our issue of Sept. 4, p. 404.

Scotland

GLASGOW, Sept. 7.

There has been some fresh enquiry on the market for spot lots but there are as yet no signs of a general increase in trading.

Refined tar.—This material is moving in steady but limited quantities at the following levels—4¼d. to 4½d. per gallon for home trade. Export business is rather erratic at about 3½d. per gallon, both f.o.r. naked.

Creosote oil.—Supplies are well looked after and prices are approximately as follows : Specification oil, 5d. to 5¼d. per gallon ; low gravity, 6d. to 6½d. per gallon ; neutral oil, 5¾d. to 6d. per gallon ; all *ex* Works in bulk.

Cresylic acid.—Buyers are showing practically no interest in this product at present and prices are : Pale, 97/99%, 1s. 11d. to 2s. per gallon ; Pale, 99/100%, 2s. 2d. to 2s. 4d. per gallon ; Dark, 97/99%, 1s. 7d. to 1s. 9d. per gallon ; all *ex* Works in buyers' packages.

Crude naphtha.—Supplies are being taken up at 6½d. to 7½d. per gallon *ex* Works in bulk, according to quality.

Solvent naphtha.—90/160 grade is 1s. 8½d. to 1s. 9d. per gallon and 90/190 heavy naphtha is 1s. 4½d. to 1s. 5½d. per gallon.

Motor benzole is 1s. 8d. to 1s. 8½d. per gallon.

Pyridine.—90/160 grade is 17s. to 18s. per gallon and 90/140 grade is 19s. to 20s. per gallon.

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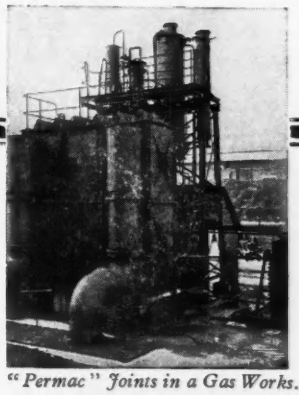

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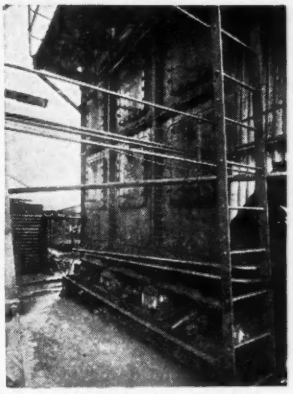

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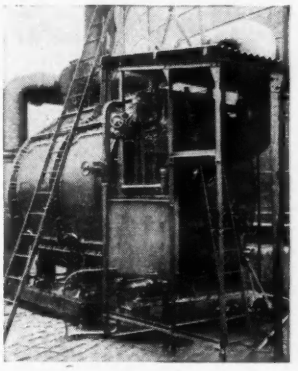

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GAS STOCKS AND SHARES

The Prime Minister's speech last week came as a tonic to the Stock Exchange, and markets closed on a cheerful tone, and although business was interrupted occasionally by air raid warnings, this did not prevent a definite increase in volume and some upward movements in prices. British Funds were steady, 2½% Consols closing at 74 xd., the same level as a week ago, and some activity developed among railway preference shares. More support was forthcoming for Industrials, several of which recorded useful rises, while rubber shares attracted more interest than for some time past.

There was a fair sprinkling of business in the Gas Market, and with few exceptions prices remained unaltered. Gas Light units moved up again, closing 3d. higher at 15s., South Metropolitan rose 2 points to 55½, and Wandsworth, on a wider margin, finished ½ up at 70. Apart from a few minor falls, the only depreciations of note were Uxbridge 5% with a drop of 10½ and Tottenham 5% pref., which closed 8 points lower at 82½.

The Directors of the South Western Gas and Water Corporation have declared an interim dividend of 2% on the ordinary shares, the same rate as for the corresponding period last year.

Quotations on the London and Provincial Stock Exchanges

OFFICIAL LIST

Issue. £	When ex-Dividend.	Dividends. Pref. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Sept. 6.	Rise or Fall on Week.
1,767,439	Mar. 11	8	7	Alliance & Dublin Ord. ...	105—115	...
374,000	July 1	4	4	Do. 4 p.c. Deb. ...	90—95	...
957,608	May 13	5	5	Asscd. Gas & Water U'd'cts Ord.	12/—14/	..
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	15/6—17/6	...
535,545	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	14/6—16/6	...
336,646	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	12/—14/—	...
561,370	Aug. 12	7	7	Barnet Ord. 7 p.c.	105—115	−3½
300,000	Apl. 8	1/4⅘	1/9⅝	Bombay, Ltd.	19/6—21/6	..
690,407	Agu. 19	7	7	Bournemouth 7 p.c. max. ...	100—110	...
362,025	June 17	4	4	Do. 4 p.c. Deb. ...	90—95	...
659,955	Aug. 19	6⅘	4⅘	Brighton, &c., 5 p.c. Con. ...	67—77*	...
855,000	Mar. 11	7	8	Brit. Gas Light Ord.	77—87	...
545,000	June 17	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb.	75—80	...
10,000	Nov. 6, '33	6	4	Cape Town, Ltd., 4½ p.c. Cu. Pf.	¼—¾	...
626,860	July 15	5⅗	6	Cardiff Con. Ord.	89—94	...
24,500	Apl. 8	7	7	Colombo Ord. 7 p.c. Pref. ...	19/6—21/6	...
764,169	Mar. 26	−/11.48	−/11.48	Colonial Gas Assn. Ltd. Ord. ...	14/6—16/6	...
400,000	,,	1/3.30	1/3.30	Do. 8 p.c. Pref. ...	20/—22/—	...
1,748,935	July 22	2	3	Commercial Ord.	37—42	...
620,000	June 10	3	3	Do. 3 p.c. Deb.	58—63	...
286,344	Aug. 19	5	5	Do. 5 p.c. Deb.	88—93	...
807,560	Aug. 12	7	6	Croydon sliding scale	87—92	...
644,590	,,	5	5	Do. max. div.	90—85	...
620,385	July 1	5	5	Do. 5 p.c. Perp. Deb. ...	90—95	...
179,500	Aug. 19	5⅝	5	East Surrey 'B,' 5 p.c.	75—80	...
176,461	June 17	5	5	Do. 5 p.c. Deb. (Irred.)...	90—95	...
250,000	July 8	4	6	Gas Consolidation Ord. 'B' ...	13/—15/—	...
250,000	May 13	4	4	Do. 4 p.c. Red. Cum. Pref.	15-/—17/—	...
19,152410	July 29	3⅜	4½	Gas Light & Coke Ord. ...	14/6—15/6a	+−/3
2,600,000	,,	3½	3½	Do. 3½ p.c. max.	54—59	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref. ...	72—77	...
2,993,000	July 8	3¾	3¾	Do. 3¾ p.c. Red. Pref. ...	78—83	...
8,602,497	June 3	3	3	Do. 3 p.c. Con. Deb. ...	65—70	...
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb. ...	99—104	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	98—103	...
700,000	Mar. 11	3½	3½	Do. 3½ Red. Deb. ...	80—85	...
5,600,000	May 13	4	8	Imperial Continental Cap. ...	38—43	+1
43,820	July 29	3½	3½	Do. 3½ p.c. Red. Deb. ...	63—68	...
231,978	Aug. 19	5	5	M.S. Utility 'C' Cons.	68—73	...
918,657	,,	4	4	4 p.c. Cons. Pref.	72—77	...
675,000	May 6	†4	†4	Montevideo, Ltd.	52—57	...
300,000	Apl. 29	9	7	Oriental, Ltd.	100—110	...
368,537	June 3	7	8	Plymouth & Stonehouse 5 p.c.	90—100	..
621,667	Aug. 19	8½	7½	Portsmouth & Gosport Cons.	97—102	...
648,999	Apl. 29	1/1½	1/1	Severn Val. Gas Cor. Ld. Ord.	14/—16/—	...
597,972	Mar. 11	−/10⅝	−/10⅝	Do. 4½ p.c. Cum. Pref. ...	16/—18/—	...
2,528,714	Sept. 2	1/−	/7½	South East'n Gas Cn. Ld. Ord.	9/6—11/6*	−1/6
1,000,000	,,	−/10⅝	−/10⅝	Do. 4½ p.c. Red. Cum. Pref.	14/—16/—*	...
1,068,869	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	13/—15/—*	...
6,709,895	Aug. 5	4	4	South Met. Ord.	53—58	+2
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	98—108	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	70—75	...
1,895,445	July 1	3	3	Do. 3 p.c. Perp. Deb. ...	60—65	...
1,000,000	July 15	5	5	Do. 5 p.c. Red. Deb. ...	95—100	...
1,543,795	July 22	3	4	South Suburban Ord. 5 p.c. ...	60—70	...
512,825	July 8	5	5	Do. 5 p.c. Perp. Pref. ...	88—93	...
500,000	,,	4	4	Do. 4 p.c. Perp. Pref. ...	71—76	...
250,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	80—85	...
888,587	June 10	5	5	Do. 5 p.c. Perp. Deb. ...	90—95	...
750,541	Aug. 19	5½	5	Southampton Ord.	65—70	...
350,000	Feb. 12	5½	5½	Swansea 5½ p.c. Red. Pref. ...	90—95	...
1,076,495	Aug. 5	5	5	Tottenham & District Ord. ...	68—78	...
338,555	,,	5	5	Do. 5 p.c. Pref.	80—85	−8
453,380	June 10	4	4	Do. 4 p.c. Perp. Deb. ...	78—83	..
1,247,505	May 20	4	6	U. Kingdom Gas Cor. Ord. ...	12/—14/—	..
1,085,952	May 13	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	14/—16/—	..
772,709	,,	4	4	Do. 4 p.c. 1st Red. Cum.Pref.	14/—16/—	...
745,263	June 17	4½	4½	Do. 4½ p.c. 2nd Non.Cum. Pf.	12/6—14/6	...
1,200,000	Mar. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	83—88	...
380,606	Aug. 5	7	6⅜	Uxbridge, &c., 5 p.c.	80—90	−10½
1,371,138	July 8	3½	4	Wandsworth Consolidated ...	65—75	+½
2,525,768	,,	4	4	Do. 4 p.c. Pref.	65—70	−2
1,343,964	June 17	5	5	Do. 5 p.c. Deb.	90—95	...
383,745	,,	4	4	Do. 4 p.c. Deb.	80—85	...
558,342	July 15	6	5	Watford & St. Albans Ord. ...	88—93	...
300,000	June 10	3½	3½	Do. 3½ p.c. Red. Deb. ...	85—90	...

SUPPLEMENTARY LIST

Issue. £	When ex-Dividend.	Dividends. Pref. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Sept. 6.	Rise or Fall on Week.
351,685	June 17	5	5	Brighton, &c., 5 p.c. Perp. Deb.	90—95	...
28,700	,, 17	5½	5½	Do. 5½ p.c. Red. Deb. 1942 ...	96—101	...
415,250	,, 17	4	4	Bristol Gas Co., 4 p.c. New Deb.	85—90	...
140,205	July 29	7	7	Cambridge, &c., 7 p.c. Cons. 'B'	100—110	...
295,932	Aug. 19	5	5	Cheltenham, 5 p.c. Cons. Ord....	88—93	...
42,500	July 1	4	4	Do. 4 p.c. Perp. Deb....	82—87	...
150,000	Aug. 12	4	4	Croydon Gas, 4 p.c. Pref. (Irr.)	70—75	...
130,000	July 1	4	4	Do. 4 p.c. Deb. ...	75—80	...
146,700	Aug. 19	5½	5½	East Surrey, 5½ p.c. Pref. 'A'	95—110	...
53,220	,, 19	6	6	Do. 6 p.c. Cum. Pref. ...	100—110	...
117,425	Feb. 5	8	8	East Wight, 5 p.c. Cons. Ord. ...	100—110	...
...	Aug. 19	6	4	Eastbourne, 'B' 3½ p.c.... ...	65—75	...
239,135	July 8	5	5	Gas Consolidation 'A' Ord. (£1)	13/6—15/6	...
156,600	Aug. 19	5	5	Hampton C't, 5 p.c. Cons. Ord.	68—73	...
18,000	June 10	7	7	Malta & Med'n., 7 p.c. 1st Pref.	60—65	...
10,845	,, 10	7½	7½	Do. 7½ p.c. 2nd Pref.	60—65	...
50,000	Aug. 19	£5 19 6	£5 4 6	Mid. South. Util., 'A' Cons. 5 p.c.	63—73	...
65,000	Aug. 12	5	5	North Middlesex, 5 p.c. Pref. ...	85—90	...
70,000	Mar. 11	5	5	Plymouth & Stone., 5 p.c. Deb.	90—95	...
76,501	July 1	4	4	Reading, 4 p.c. Perp. Deb. ...	75—80	...
74,777	April 1	4	4	Romford, 4 p.c. Debs. (Reg.) ...	85—90	...
21,000	June 10	5	5	Slough, 5 p.c. Perp. Deb. ...	90—95	...
211,740	,, 17	5	5	Southampton, 5 p.c. Red. Deb.	96—101	..
363,575	July 1	5	5	Tottenham, 5 p.c. Reg. Red. Mt.	95—100	...
202,019	Mch. 18	7½	6⅝	Tunbridge Wells, 4 p.c. Scale ...	70—80	...
135,257	June 10	5	5	Uxbridge &c., 5 p.c. Perp. Deb.	90—95	...

PROVINCIAL EXCHANGES

347,756	July 26	6	5	Bath Cons.	98—103	...
122,577	Feb. 19	7	7	Blyth 5 p.c. Ord.	109—111	...
1,667,250	July 15	5	5	Bristol, 5 p.c. max.	90—92	...
120,420	June 17	4	4	Do. 1st 4 p.c. Deb.	94—96	...
415,250	,,	4	4	Do. 2nd 4 p.c. Deb.	92—95	...
328,790	,,	5	5	Do. 5 p.c. Deb.	108—111	...
157,150	Aug. 5	6½	5	Chester 5 p.c. Ord.	98—101	..
92,500	June 17	4	4	Do. 4 p.c. Pref.	80—85	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	80—85	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	94—98	...
542,270	Feb. 12	6	9	Derby Cons.	103—108	...
55,000	June 10	4	4	Do. 4 p.c. Deb.	96—102	..
10,000	Aug. 19	10	10	Great Grimsby 'A' Ord.	170—180	...
6,500	,,	10	10	Do. 'B' Ord.	170—180	...
79,000	,,	10	10	Do. 'C' Ord.	160—170	..
732,000	Feb. 19	4	4	Hartlepool G. & W. Cn. & New	63—68	...
2,167,410	Aug. 19	6	6	Liverpool 5 p.c. Ord.	96—98	...
245,500	June 17	5	5	Do. 5 p.c. Red. Pref. ...	97½—100½	...
306,083	July 15	4	4	Do. 4 p.c. Deb.	99—101	...
20,000	June 24	5	5	Long Eaton 5 p.c. Pref.	9—11	...
80,000	June 24	5	5	Do. 5 p.c. Deb.	100—105	...
2,430,267	July 29	5 7/10	5	Newcastle and Gateshead Con.	15/6—16/6a	...
682,856	,,	4	4	Do. 4 p.c. Pref.	73—75	...
776,706	Dec. 27	3½	3½	Do. 3½ p.c. Deb.	80—85	...
277,285	April 24	5	5	Do. 5 p.c. Deb. '43 ...	97—102	...
274,000	July 26	5	5	Newport (Mon.) Ord.	89—93	...
13,200	Mch. 26	7	8⅜	Pontyp'l Gas & W. 10 p.c. 'A'	11½—12½	...
13,600	,,	5	6	Do. 7 p.c. 'B'	9½—10½	...
40,000	,,	5	6	Do. 7 p.c. 'C'	9½—10½	..
106,280	Aug. 5	8	10	Preston 'A' 10 p.c.	157—167	...
188,219	,,	7	7	Do. 'B' 7 p.c.	113—123	...
1,806,339	Aug. 26	6½	6½	Sheffield Cons.	117½—120½	...
95,000	July 8	4	4	Do. 4 p.c. Deb.	97— 99	...
332,351	Feb. 5	6	6	Sunderland 6 p.c. max. ...	107—112	...
140,778	Aug. 12	5	5	Weston-super-Mare Cons. ...	87—90	...
64,338	June 24	4	4	Do. 4 p.c. Deb.	90—95	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	137—145	−4

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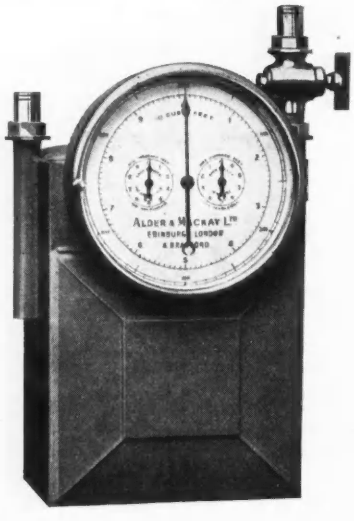

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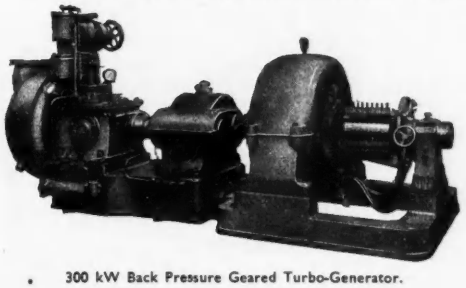

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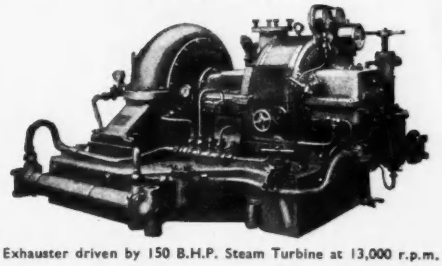

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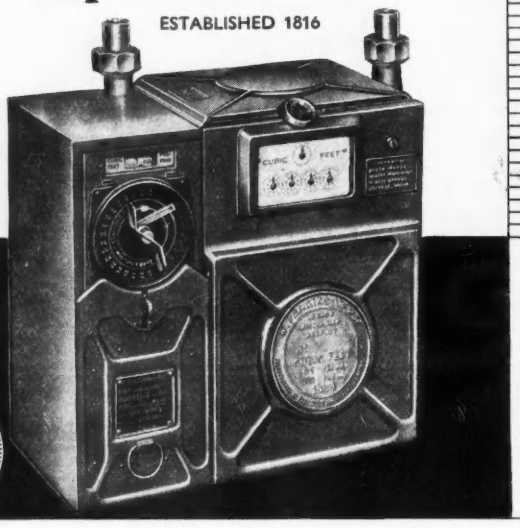

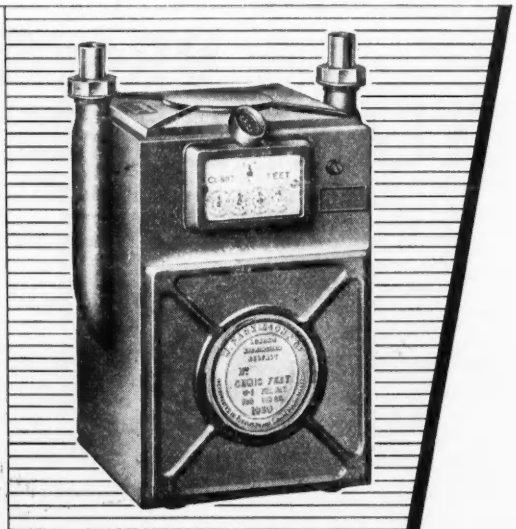

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